

Study on the Migration of Silver Nanoparticles from Nano silver Food Packages into Food Liquid

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Abstract

Original Research Article

The need for healthy food is much stringent than before. Food packaging is an important part in the production of food. The migration of silver nanoparticles in nanosilver packages should be detected carefully. In this paper, the migration of silver nanoparticles in nano-silver/polypropylene milk storage packages was studied by UV-vis, which could be available in the evaluation of food packages.

Key words: Food package, Silver nanoparticles, food soup.

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INTRODUCTION

Nowadays, great attention has been paid to the health and safety of food. The desire for healthy food is much stronger than before. People are searching for natural, original, non-synthetic food. Nanotechnology is booming fast since 1990s, it has been integrated into the fields of medicine, biology, environment, energy, and agriculture and food science [1, 2]. Food packaging is an important part in the conservation of food. Conventional packaging systems are designed to act as passive barriers against surrounding environment, which behave poorly in antimicrobial activity. Compared to conventional packaging, nanotechnology-enabled food packaging can be divided into two different key points: (i) improved packaging, where nanomaterials are mixed into the polymer matrix to improve the gas barrier properties such as polymer/clay nanocomposites; (ii) active packaging, where the nanoparticles interact directly with the food or environment to allow a better protection of the food [3].

Silver-based material is a kind of antibiotic with a broad spectrum of activity, which have also attracted great interest owing to its photoactivity of semiconductor photocatalysis, antibacterial activity and the presence of nanocrystallites [5-7]. While too much intake into body may have influence on the health of people, it is very important to detect the amount of silver nanoparticles in food packages.

MATERIALS AND METHODS

Materials and apparatus

Four commercially available nano-silver/polypropylene milk storage packages were selected as research objects, and marked as A, B, C, D, respectively. White vinegar, plant Oil, milk, hot pot soup and deionized water were poured into four packages of A, B, C, D, respectively, and the packages were soaked for 60 days at room temperature. Every 5 days, the liquid samples of different packages were tested by UV-vis spectrometer (UV-2802PCS, UNICO).

Migration of silver nanoparticles

The migration situation of silver nanoparticles in packages was detected by UV-vis spectroscopy. The migration amount could be calculated by standard working curve of silver nanoparticles.

RESULTS AND DISCUSSION

Compared with deionized water, the UV spectra of white vinegar, plant oil, milk, hot pot soup were shown as follows. As shown in Fig.1, the migration of silver nanoparticles changed little in 60 days. And the differences of migration amount of the four nano-silver/polypropylene milk storage packages were little.

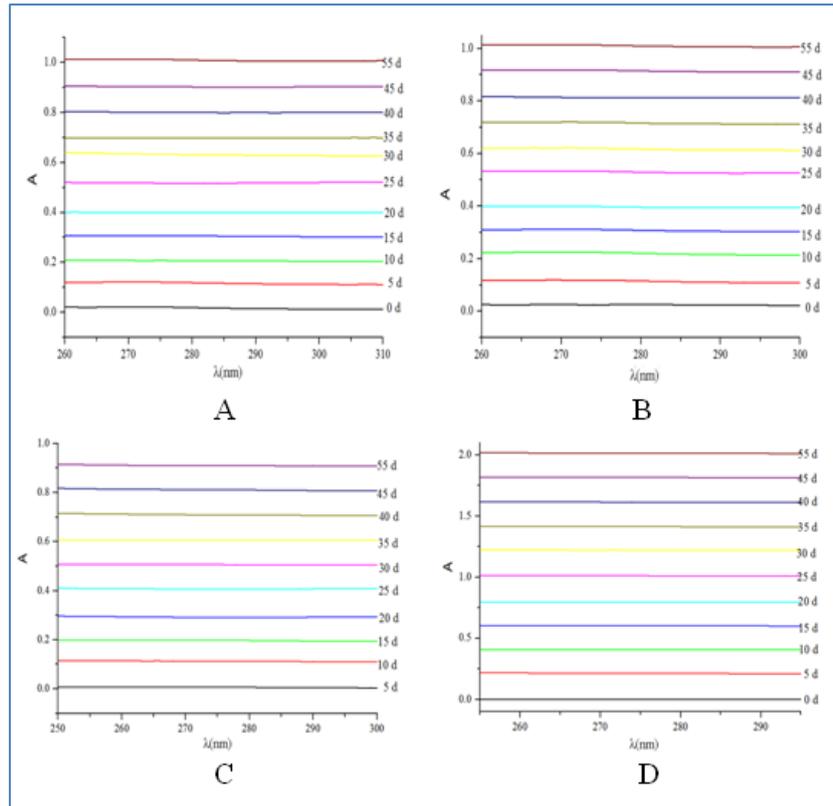


Fig-1: Migration of nanosilver in different samples after soaking in deionized water

As we all know that the ingredients of hot pot soup were complex, the migration of silver nanoparticles changed obviously as the days went on as shown in Fig.2. It was shown that the migration of silver nanoparticles changed abnormally in the former 15 days, which might due to the decay of the hot pot soup. In a word, the migration of silver nanoparticles

increased greatly in the food soup than in a simulated food liquid, and the migration amount is higher than that of in a simulated food liquid. The migration conditions of silver nanoparticles in four nano-silver/polypropylene milk storage packages were different, which might be attributed to the techniques by which the packages were made.

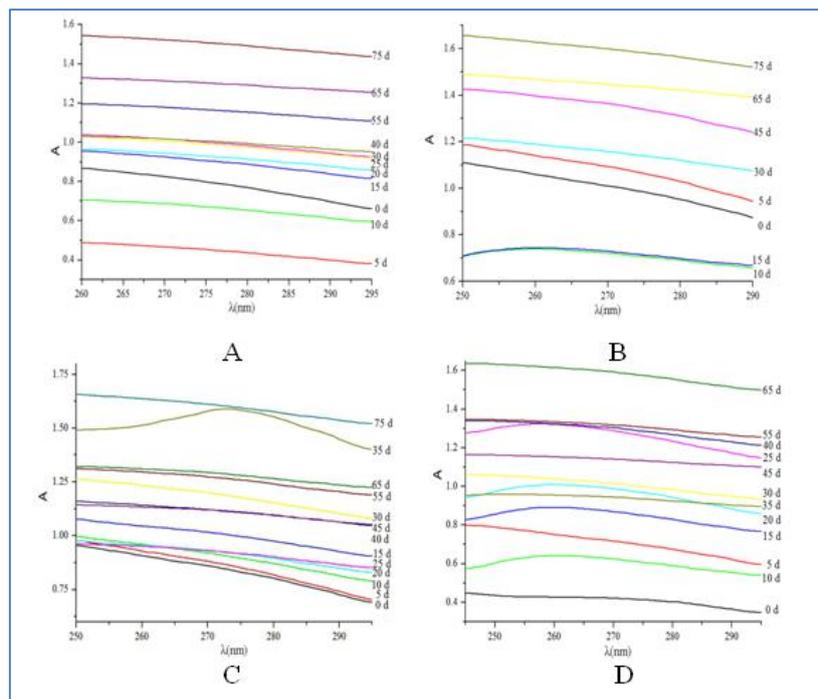


Fig-2: Migration of nanosilver in different samples after soaking in hot pot soup

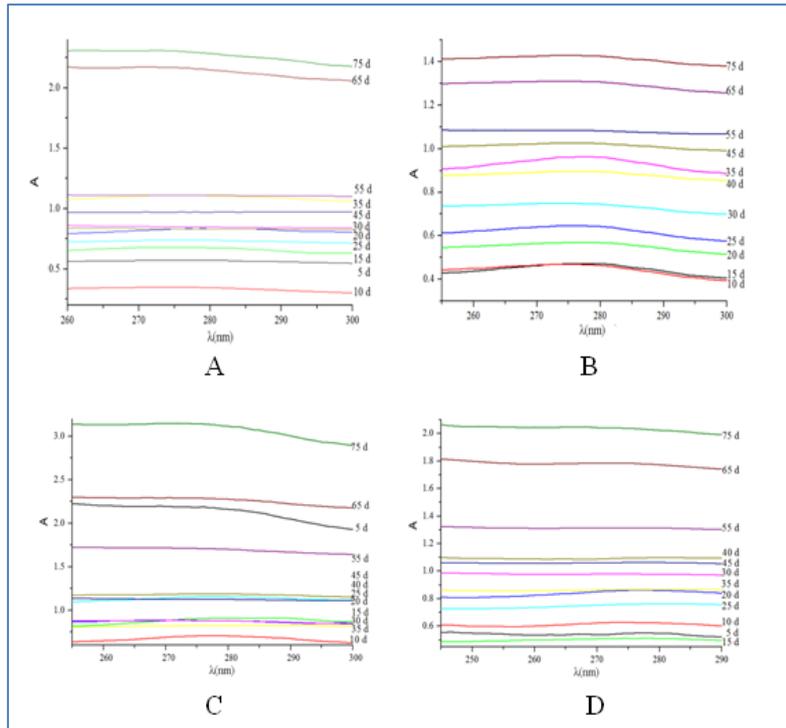


Fig-3: Migration of nanosilver in different samples after soaking in milk

While soaked in milk, as shown in Fig.3, the migration of silver nanoparticles presented two stages. In the first stage, the migration amount of silver nanoparticles was low; in the second stage, the

migration amount was higher. The migration rule of silver nanoparticles in four nano-silver/polypropylene milk storage packages were the same.

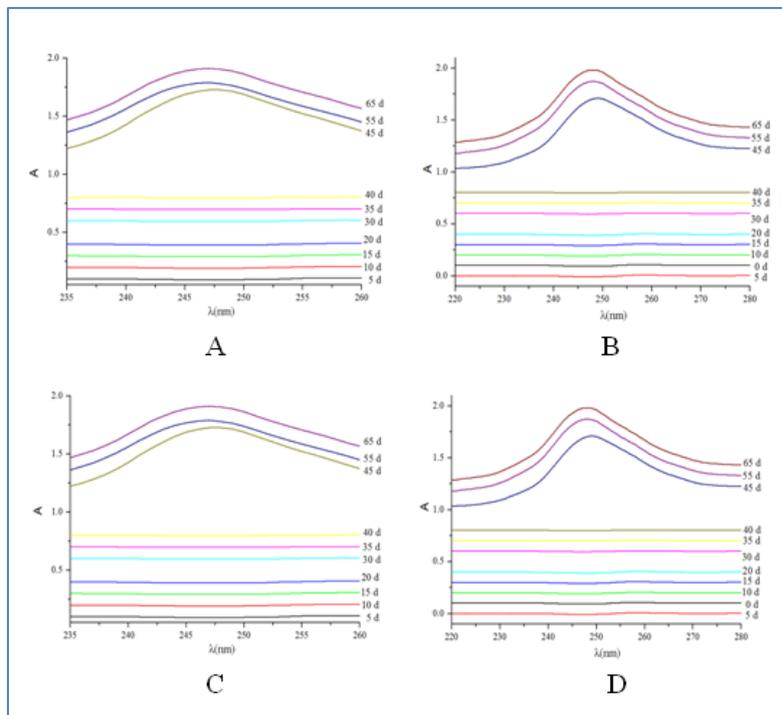


Fig-4: Migration of nanosilver in different samples after soaking in white vinegar

While soaked in white vinegar, as shown in Fig.4, the migration amount of silver nanoparticles in four storage packages were very high, and also

presented two stages. After soaking for 45 days, the absorption peak blue-shifted obviously.

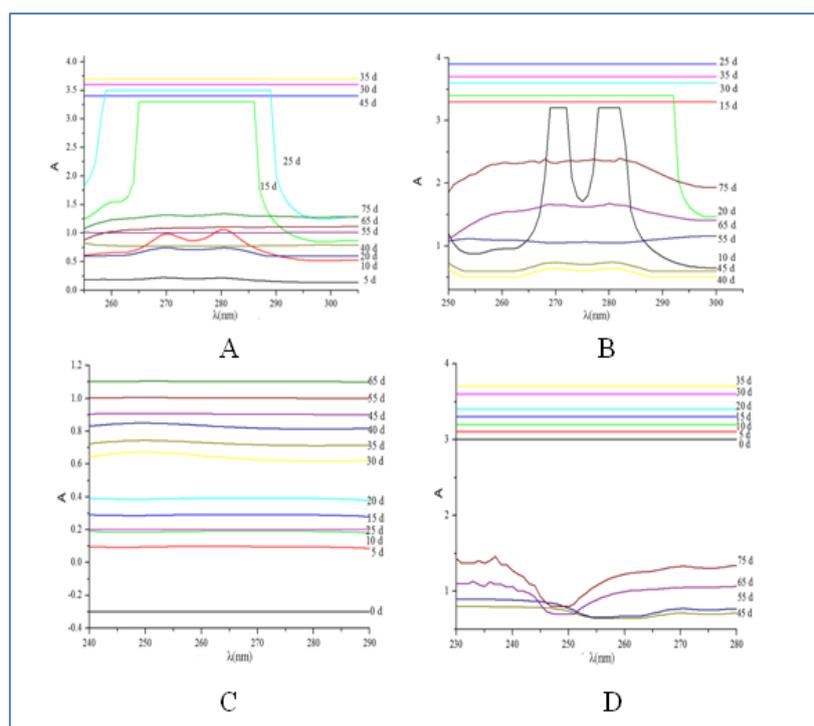


Fig-5: Migration of nanosilver in different samples after soaking in plant oil

While soaked in plant oil as shown in Fig.5, the migration of silver nanoparticles also presented two stages. In the former 35 days, the migration amount of silver nanoparticles was low; in the second stage, the migration conditions were more complicated. There were two adsorption peaks in A and B package, which might be the influence of parameter agent of cyclohexane [8].

CONCLUSION

In this paper, it was found that the migration of silver nanoparticles in food liquid are totally different compared with simulated liquids or chemical reagents. The result showed that the migration amount of silver nanoparticles was as follows: White vinegar>Plant Oil>Milk>Hot Pot solution>Water.

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